



## General

### Guideline Title

ACR Appropriateness Criteria® chronic neck pain.

### Bibliographic Source(s)

Newman JS, Weissman BN, Angevine PD, Appel M, Arnold E, Bencardino JT, Fries IB, Hayes CW, Hochman MG, Holly LT, Jacobson JA, Math KR, Murphey MD, O'Toole JE, Rubin DA, Scharf SC, Small KM, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® chronic neck pain. [online publication]. Reston (VA): American College of Radiology (ACR); 2013. 14 p. [61 references]

### Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Daffner RH, Weissman BN, Angevine PD, Arnold E, Bancroft L, Bennett DL, Blebea JS, Bruno MA, Fries IB, Holly L, Jacobson JA, Luchs JS, Morrison WB, Resnik CS, Roberts CC, Schweitzer ME, Seeger LL, Stoller DW, Taljanovic MS, Wise JN, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® chronic neck pain. [online publication]. Reston (VA): American College of Radiology (ACR); 2010. 9 p.

## Recommendations

### Major Recommendations

ACR Appropriateness Criteria®

Clinical Condition: Chronic Neck Pain

Variant 1: Patient with chronic neck pain without or with a history of previous trauma. First study.

Radiologic Procedure	Rating	Comments	RRL*
X-ray cervical spine	9	AP and lateral (may be supplemented with swimmer's and/or open mouth views).	<input type="text"/> <input type="text"/>
MRI cervical spine without contrast	2		O
Facet injection/medial branch block cervical spine	1	Never indicated as initial study.	<input type="text"/> <input type="text"/>

Radiologic Procedure	Rating	Comments	RRL*
Myelography cervical spine		Never indicated as initial study.	<input type="text"/> <input type="text"/>
CT cervical spine without contrast	1	Never indicated as initial study.	<input type="text"/> <input type="text"/> <input type="text"/>
Tc-99m bone scan with SPECT neck	1	Never indicated as initial study.	<input type="text"/> <input type="text"/> <input type="text"/>
Myelography and post myelography CT cervical spine	1	Never indicated as initial study.	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
MRI cervical spine without and with contrast	1		O
CT cervical spine with contrast	1		<input type="text"/> <input type="text"/> <input type="text"/>
CT cervical spine without and with contrast	1		<input type="text"/> <input type="text"/> <input type="text"/>
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 2: Patient with chronic neck pain with history of previous malignancy. First study.

Radiologic Procedure	Rating	Comments	RRL*
X-ray cervical spine	9	AP and lateral (may be supplemented with swimmer's and/or open mouth views).	<input type="text"/> <input type="text"/>
MRI cervical spine without contrast	2		O
CT cervical spine without contrast	2	Only if MRI is contraindicated.	<input type="text"/> <input type="text"/> <input type="text"/>
Tc-99m bone scan whole body with SPECT neck	2		<input type="text"/> <input type="text"/> <input type="text"/>
MRI cervical spine without and with contrast	1		O
CT cervical spine with contrast	1		<input type="text"/> <input type="text"/> <input type="text"/>
Rating Scale: 1.2.3 Usually not appropriate; 4.5.6 May be appropriate; 7.8.9 Usually appropriate			*Relative



Radiologic Procedure	Rating	Comments	RRL*
			<input type="text"/>
Tc-99m bone scan with SPECT neck	1		<input type="text"/> <input type="text"/> <input type="text"/>
Facet injection/medial branch block cervical spine	1		<input type="text"/> <input type="text"/>
Myelography and post myelography CT cervical spine	1		<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
MRI cervical spine without and with contrast	1		O
CT cervical spine with contrast	1		<input type="text"/> <input type="text"/> <input type="text"/>
CT cervical spine without and with contrast	1		<input type="text"/> <input type="text"/> <input type="text"/>
<u>Rating Scale:</u> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 5: Radiographs normal. Neurologic signs or symptoms present.

Radiologic Procedure	Rating	Comments	RRL*
MRI cervical spine without contrast	9		O
Myelography and post myelography CT cervical spine	5	If MRI contraindicated.	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
CT cervical spine without contrast	5	If MRI contraindicated.	<input type="text"/> <input type="text"/> <input type="text"/>
Facet injection/medial branch block cervical spine	3	MBB may be used to confirm facet as specific pain generator, generally third line test following MRI or CT.	<input type="text"/> <input type="text"/>
MRI cervical spine without and with contrast	2		O
X-ray myelography cervical spine	2		<input type="text"/> <input type="text"/> <input type="text"/>
<u>Rating Scale:</u> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative

Radiologic Procedure	Rating	Comments	RRL*
CT cervical spine with contrast	2		
CT cervical spine without and with contrast	2		
Tc-99m bone scan with SPECT neck	2		
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 6: Radiographs show degenerative changes. No neurologic findings.

Radiologic Procedure	Rating	Comments	RRL*
MRI cervical spine without contrast	5	Persistent pain following failure of conservative management.	O
CT cervical spine without contrast	3	Following conservative management if MRI contraindicated.	
Myelography and post myelography CT cervical spine	2		
Tc-99m bone scan with SPECT neck	2		
Facet injection/medial branch block cervical spine	2	MBB may be used to confirm facet as specific pain generator, generally third line test following MRI or CT.	
MRI cervical spine without and with contrast	1		O
X-ray discography cervical spine	1		
CT cervical spine with contrast	1		
CT cervical spine without and with contrast	1		
Myelography cervical spine	1	Should not be performed without CT.	*Relative Radiation Level

Radiologic Procedure	Rating	Comments	RRL*
<u>Rating Scale:</u> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 7: Radiographs show degenerative changes. Neurologic signs or symptoms present.

Radiologic Procedure	Rating	Comments	RRL*
MRI cervical spine without contrast	9		O
Myelography and post myelography CT cervical spine	5	If MRI contraindicated.	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
CT cervical spine without contrast	5	If MRI contraindicated.	<input type="text"/> <input type="text"/> <input type="text"/>
Facet injection/medial branch block cervical spine	3	MBB may be used to confirm facet as specific pain generator, generally third line test following MRI or CT.	<input type="text"/> <input type="text"/>
Tc-99m bone scan with SPECT neck	2		<input type="text"/> <input type="text"/> <input type="text"/>
X-ray myelography cervical spine	1	Should not be performed without CT.	<input type="text"/> <input type="text"/> <input type="text"/>
MRI cervical spine without and with contrast	1		O
X-ray discography cervical spine	1		<input type="text"/> <input type="text"/>
CT cervical spine with contrast	1		<input type="text"/> <input type="text"/> <input type="text"/>
CT cervical spine without and with contrast	1		<input type="text"/> <input type="text"/> <input type="text"/>
<u>Rating Scale:</u> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 8: Radiographs show old trauma. No neurologic findings.

Radiologic Procedure	Rating	Comments	RRL*
MRI cervical spine without contrast	5	Persistent pain following failure of conservative management.	O
CT cervical spine without contrast	3	Following conservative management if MRI contraindicated.	<input type="text"/> <input type="text"/> <input type="text"/>
X-ray myelography cervical spine	2		<input type="text"/> <input type="text"/> <input type="text"/>
Myelography and post myelography CT cervical spine	2		<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
Tc-99m bone scan with SPECT neck	2		<input type="text"/> <input type="text"/> <input type="text"/>
Facet injection/medial branch block cervical spine	1		<input type="text"/> <input type="text"/>
MRI cervical spine without and with contrast	1		O
X-ray discography cervical spine	1		<input type="text"/> <input type="text"/>
CT cervical spine with contrast	1		<input type="text"/> <input type="text"/> <input type="text"/>
CT cervical spine without and with contrast	1		<input type="text"/> <input type="text"/> <input type="text"/>
<u>Rating Scale:</u> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 9: Radiographs show old trauma. Neurologic signs or symptoms present.

Radiologic Procedure	Rating	Comments	RRL*
MRI cervical spine without contrast	9		O
Myelography and post myelography CT cervical spine	5		<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
<u>Rating Scale:</u> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Radiologic Procedure	Rating	Comments	RRL*
Tc-99m bone scan with SPECT neck	3	Localize pain source.	<input type="text"/>
			<input type="text"/>
Facet injection/medial branch block cervical spine	2		<input type="text"/>
			<input type="text"/>
X-ray myelography cervical spine	1	Should not be performed without CT.	<input type="text"/>
			<input type="text"/>
			<input type="text"/>
MRI cervical spine without and with contrast	1		O
X-ray discography cervical spine	1		<input type="text"/>
			<input type="text"/>
CT cervical spine with contrast	1		<input type="text"/>
			<input type="text"/>
			<input type="text"/>
CT cervical spine without and with contrast	1		<input type="text"/>
			<input type="text"/>
			<input type="text"/>
<u>Rating Scale:</u> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 10: Radiographs show disc margin destruction or bone lesion suggestive of infection or malignancy.

Radiologic Procedure	Rating	Comments	RRL*
MRI cervical spine without contrast	9		O
MRI cervical spine without and with contrast	9	See statement regarding contrast in text below under "Anticipated Exceptions."	O
CT cervical spine with contrast	5	CT with contrast should be performed if MRI is unavailable or cannot be performed or when disc space infection/osteomyelitis is suspected.	<input type="text"/>
			<input type="text"/>
			<input type="text"/>
CT cervical spine without contrast	3		<input type="text"/>
			<input type="text"/>
			<input type="text"/>
Tc-99m bone scan with SPECT neck	2		<input type="text"/>
			<input type="text"/>
			<input type="text"/>
X-ray myelography cervical spine	1		<input type="text"/>
			<input type="text"/>
			<input type="text"/>
<u>Rating Scale:</u> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation



Contrast Radiologic Procedure	Rating	Comments	RRL*
Myelography and post myelography CT cervical spine	1		
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 11: Prior C-spine surgery (including ACDF) with radiographs showing no complication. Next study.

Radiologic Procedure	Rating	Comments	RRL*
CT cervical spine without contrast	7	CT best examination to assess for hardware complication, extent of fusion.	
MRI cervical spine without contrast	5		O
X-ray myelography cervical spine	2		
Tc-99m bone scan with SPECT neck	2		
CT cervical spine with contrast	1		
CT cervical spine without and with contrast	1		
MRI cervical spine without and with contrast	1	Unless there is a concern for infection.	O
Facet injection/medial branch block cervical spine	1		
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Variant 12: Radiographs show OPLL. Next study.

Radiologic Procedure	Rating	Comments	RRL*
CT cervical spine without contrast	7	Best for depicting osseous masses.	*Relative Radiation Level

Radio logical Procedure	Rating	Best for detection of myelopathy, disc herniation.	BRL*
X-ray myelography cervical spine	2		<input type="text"/> <input type="text"/> <input type="text"/>
CT cervical spine with contrast	1		<input type="text"/> <input type="text"/> <input type="text"/>
CT cervical spine without and with contrast	1		<input type="text"/> <input type="text"/> <input type="text"/>
MRI cervical spine without and with contrast	1		O
Tc-99m bone scan with SPECT neck	1		<input type="text"/> <input type="text"/> <input type="text"/>
Facet injection/medial branch block cervical spine	1		<input type="text"/> <input type="text"/>
<u>Rating Scale:</u> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

## Summary of Literature Review

### Introduction/Background

The patient with chronic neck pain presents both diagnostic and therapeutic dilemmas for the clinician because of considerable controversy in the literature over its etiology, as well as the role of imaging in its evaluation. The literature focuses on two general categories: post-traumatic and mechanical/degenerative, but in most cases, multiple etiological factors are present. Post-traumatic etiologies include the so-called "whiplash" syndrome, defined as any injury to the cervical vertebrae and adjacent soft tissues as a result of sudden jerking. This classically includes extension-flexion mechanisms sustained in rear-end motor vehicle collisions (MVC) as well as abrupt lateral flexion mechanisms. Research in Canada and Scandinavia has identified a constellation of signs and symptoms termed whiplash-associated disorders (WAD). The Quebec task force provided a grading system of WAD according to severity of injury.

Mechanical/degenerative conditions include spondylosis, disc degeneration, acute disc herniation and facet joint osteoarthritis. These conditions may also result from prior acute injury. Chronic neck pain and/or neurologic symptoms may also be seen in patients with prior cervical spine surgery as well as in the setting of ossification of the posterior longitudinal ligament (OPLL). Finally, there are anecdotal reports in the literature about other etiologies of chronic neck pain that include carotid or vertebral artery dissection, arteriovenous malformations, and tumors.

### Epidemiology

For this review, 60 papers are included in the bibliography. Three early studies evaluated the largest groups of patients with chronic neck pain: the first study with 7,270 patients; the Quebec Task Force study with 3,014 patients; and a third study involving 5,440 patients. The Quebec study focused entirely on whiplash. The other two studies focused on the etiologies of neck pain in relation to other contributing factors.

The first research group studied a representative sample of Finnish adults and found the chronic neck syndrome occurring in 10% of men and 14% of women. Contributing features of symptoms included previous history of trauma and mental and physical stress at work.

The third study confirmed observations made by other investigators on smaller patient populations that disc disease is more likely to cause neck pain in men but not in women. In patients with spondylosis, they found that the presence of pain is related more closely to features such as personality traits and the presence of previous injury.

The Quebec Task Force on Whiplash evaluated its members' experience with the disorder. It used consensus methods similar to those followed by the ACR Appropriateness Criteria® expert panels. The task force developed a flow sheet defining WAD and made recommendations for diagnosis and management.

A more recent series described a prevalence of neck pain of 2.2% in North Carolina residents based on phone interviews of over 5,000 individuals. In this cohort, 79.3% of patients with neck pain had at least one provider visit for their neck problems over the prior year. This group underwent a mean of 1.58 diagnostic tests: 45.1% underwent radiographs, 24.0% computed tomography (CT), 30.2% magnetic resonance imaging (MRI) and 7.4% myelography/discography. The authors conclude that diagnostic imaging was over utilized in this population.

In another recently published report, risk factors for chronic neck pain among 5,277 middle aged, Finnish municipal employees were evaluated by documenting the incidence of chronic neck pain developing over a 5-7 year follow-up. The incidence was 15% in females, 9% in men. Modifiable predictors of chronic neck pain included workplace bullying, sleep problems, high body mass index and workplace emotional exhaustion.

### Whiplash Injury

The role of prior whiplash injury in the subsequent development of chronic neck pain is of particular interest. A cohort of 919 adults in Saskatchewan, Canada, were studied and it was found that a past history of neck injury in a MVC was associated with the development of future neck pain. The authors speculate that causation is likely multi-factorial, involving biological, psychological and social factors. While spondylosis and disc disease increase with age and are frequently asymptomatic, whiplash can accelerate these processes and lead to symptoms. For these reasons, no variant specifically addressed whiplash per se.

### Overview of Imaging Modalities

Conventional radiographs are the mainstay in the initial imaging evaluation of patients with chronic neck pain. Prior studies cite the use of radiographs, particularly to diagnose spondylosis, degenerative disc disease, malalignment or spinal canal stenosis. AP and lateral views are recommended. The addition of a swimmer's view may be necessary for improved visualization of the cervicothoracic junction. A supplemental open mouth view should be considered in the setting of suspected atlantodental disease such as with a history of inflammatory arthropathy or rotatory abnormalities such as torticollis. Based on limited supporting data in the literature and in an attempt to limit radiation dose, it is the consensus of the expert panel that oblique radiographs are no longer recommended as part of the initial radiographic evaluation of the cervical spine in the setting of chronic neck pain.

In the setting of suspected instability, supplemental flexion/extension radiographs may be considered. Flexion/extension radiographs have been shown to document atlantoaxial instability in rheumatoid arthritis and Down syndrome, as well as in the diagnosis of pseudarthrosis following anterior cervical discectomy and fusion (ACDF). Flexion/extension radiographs may also be employed in the evaluation of kinematics following cervical disc implantation and in the assessment of the integrity of posterior cervical fixation. In the setting of degenerative disease, however, flexion/extension views appear to be of more limited clinical value.

Following radiography, a subset of patients with chronic neck pain may benefit from MRI or even from CT. These indications will be detailed below as will the potential role for X-ray myelography with CT and interventions such as facet injection.

### Magnetic Resonance Imaging

The utility of MRI in the evaluation of patients with chronic neck pain and degenerative cervical disorders is now well established. Given its lack of ionizing radiation, excellent depiction of bone marrow signal, intervertebral discs, facet arthropathy and spinal stenosis, MRI has supplanted CT as the first line advanced imaging study in patients with chronic neck pain. Furthermore, cervical MRI examinations frequently include the upper thoracic spine, where degenerative changes have been shown to be associated with cervical symptoms. In the patient with neurologic symptoms, MRI readily depicts myelopathic changes in the cervical spinal cord. The utility of flexion/extension MRI in this setting has also been demonstrated, but may be impractical in routine, daily practice.

In patients with neck pain, but without neurologic symptoms, the relevance of specific MRI findings in the cervical spine should be considered in light of expected changes associated with aging. In a 10-year longitudinal MRI study, researchers showed that cervical disc degeneration progressed in 85% of patients, though symptoms developed in only 34% of patients. Most significantly, patients who developed symptoms showed more frequent progression of disc degeneration on MRI including anterior compression of disc and spinal cord and foraminal stenosis. MRI may offer additional characterization of degenerative changes including facet disease and may reveal an unsuspected facet synovial cyst which may be amenable to image guided percutaneous treatment. The presence of facet degenerative changes should be interpreted with caution, however. In a small series, another group of researchers found little correlation between the presence of facet arthropathy and the side or level of symptoms in patients with acute, unilateral neck pain. Whether or not neurologic symptoms are present, there are a number of specific indications for MRI including suspected malignancy or infection (discitis, osteomyelitis); especially, when radiographs are abnormal. In these instances, MRI

without and with intravenous contrast should be obtained. In the setting of dialysis associated spondyloarthropathy, MRI may reveal low signal intensity within affected disc spaces on T2-weighted images, allowing differentiation from infectious spondylodiscitis. MRI may offer specific anatomic information which is helpful in the diagnosis of atlantoaxial instability, even in the absence of dynamic imaging.

In the setting of whiplash associated injury there remains no consensus on the usefulness of MRI in evaluating the ligaments and membranes of the craniocervical junction. While one research group felt that MRI could show structural changes in ligaments and membranes and concluded that there was correlation between clinical impairment and morphologic findings, another group found trauma-related MRI findings to be rare in WAD (7 of 178 patients). In two separate reports, another group of authors found no significant differences in the MRI findings of signal changes of the craniocervical ligaments in WAD patients relative to symptomatic and asymptomatic control groups. A commentary on this paper concluded that signal changes in alar ligaments are not reliable enough to indicate that ligament damage has occurred. The author of the commentary reiterated the conclusions of the Task Force on Neck Pain, of which he is a member, that "The validity of high-intensity signal MRI findings in the upper cervical spine ligaments as representing acute whiplash injury had not been demonstrated". Another recent study demonstrated that alar and transverse ligament signal within one year of injury most likely reflected normal variation.

### Computed Tomography and CT Myelography

Is there a role for cervical CT in patients with chronic neck pain? Certainly, advances in multidetector, helical CT scanning with high quality multiplanar reconstructions have enhanced the efficacy of CT, particularly around hardware. CT also offers superior depiction of cortical bone. CT is more sensitive than radiographs in the assessment of facet degenerative disease, including osteophyte formation, vacuum phenomenon as well as joint capsular calcification. The Task Force on Neck Pain felt that cervical CT scans had better validity than radiographs in assessing high-risk and/or multi-injured blunt trauma patients. There is also consensus among the members of the Musculoskeletal Imaging Expert Panel that CT myelography is a viable alternative to MRI for patients with suspected cord involvement, when MRI cannot be performed. CT myelography may be particularly advantageous in evaluating osseous lesions which contribute to canal or foraminal narrowing.

CT is of value in assessing patients following ACDF. The technique is useful in evaluating the extent of fusion as well as complications such as hardware failure, pseudarthrosis and in patients with post-procedural dysphagia. In patients who have not undergone prior surgery, MRI has supplanted CT as the cross-sectional modality of choice, though some surgeons prefer CT for operative planning, by virtue of the superior osseous detail. While CT (or MRI) may aid in assessing the onset of adjacent segment degeneration post-fusion, X-rays alone may be sufficient. In the setting of OPLL, CT may aid in characterization of disease extent. Finally, CT may be of value in the evaluation of the atlantoaxial joint in cases of non-traumatic torticollis.

### Technetium (Tc)-99m Bone Scan

The role of nuclear scintigraphy (Tc-99m bone scan) in the setting of chronic neck pain is limited, though single photon emission computed tomography (SPECT) likely offers benefit over conventional planar imaging. Some authors have advocated the use of SPECT imaging in identifying the pain source (i.e., facet disease); others have described its use in postoperative neck pain. Whole body bone scanning, employed in the setting of malignancy may reveal cervical spine metastases as well as metastatic lesions elsewhere in the skeleton.

### Discography and Diagnostic Spinal Injections

The use of provocative injections in the cervical spine to identify a pain source is controversial. The Bone and Joint Decade 2000–2010 Task Force on Neck Pain and its Associated Disorders concluded that there was no evidence to support using cervical provocative discography or anesthetic facet or nerve blocks. Provocative cervical discography is not only technically demanding, but may result in significant complications. The use of facet injection as a diagnostic maneuver is limited by frequent leakage of anesthetic into adjacent spaces resulting in false positive results. On the other hand, image-guided medial branch nerve blocks (MBB) may be the most efficacious way of isolating a specific facet joint as the pain generator. This may be followed by thermal ablation of the median branch under fluoroscopic guidance.

### Clinical Scenarios

This review considered a number of clinical scenarios in which patients presented with chronic neck pain. The authors attempted to determine the optimal first study to be performed in patients without or with a history of remote trauma and in patients with a history of previous malignancy or previous remote surgery.

Six clinical scenarios address patients with normal radiographs, without and with degenerative changes or posttraumatic deformity and without and with neurologic symptoms. The authors then separately consider patients with radiographs showing signs of malignancy or infection, radiographs showing OPLL and the symptomatic patient with a remote history of neck surgery, particularly following ACDF. Whiplash was not considered as a separate entity, since patients with WAD will fit into one of the categories listed above.

### Summary

These guidelines apply to imaging of patients with chronic neck pain regardless of the etiology (trauma, arthritis, neoplasm):

- Patients of any age with chronic neck pain without or with a history of trauma should initially undergo AP and lateral radiographs of the cervical spine; supplemented, in select cases, by swimmer's and/or open mouth views. Oblique views are no longer recommended as a standard part of the initial radiographic evaluation.
- Patients with a history of C-spine surgery in the past should initially undergo, at minimum, AP and lateral radiographs, with consideration of additional flexion/extension views.
- Patients with a history of previous malignancy should initially undergo AP and lateral radiographs, supplemented, if necessary, by swimmer's and/or open mouth views. Radionuclide bone scanning should not be the initial procedure of choice (Spitzer et al., 1995).
- Flexion/extension lateral radiographs may offer supplemental diagnostic information in the setting of suspected instability or in symptomatic patients with a history of prior surgery including ACDF, cervical prosthetic disc placement or posterior instrumentation.
- Patients with normal radiographs and no neurologic signs or symptoms need no immediate further imaging.
- Patients with normal radiographs and neurologic signs or symptoms should undergo cervical MRI that includes the craniocervical junction and the upper thoracic region (Kaale et al., 2005; Boutin, Steinbach, & Finnesey, 2000; Chen et al., 2003). If there is a contraindication to the MRI examination such as a cardiac pacemaker or severe claustrophobia, CT or CT myelography with multiplanar reconstruction is recommended.
- Patients with chronic neck pain from whiplash should undergo imaging following the guidelines above.
- Many patients with radiographic evidence of degenerative changes including cervical spondylosis or of previous trauma *without* neurologic signs or symptoms need no further imaging. In other patients, particularly after failure of conservative management, MRI should be considered. In patients for whom surgery is contemplated, additional imaging with MRI or CT may be indicated for operative planning.
- Patients with radiographic evidence of cervical spondylosis or of previous trauma and neurologic signs or symptoms should undergo MRI. CT or CT myelography may also be of value, particularly if MRI is contraindicated.
- Patients with radiographic evidence of bone or disc margin destruction should undergo MRI without and with intravenous contrast. CT with intravenous contrast is indicated only if MRI cannot be performed.
- While therapeutic injections may offer benefit, diagnostic facet injection to identify the specific level(s) producing symptoms is of more limited value. Confirmation of a specific facet joint as a pain generator may be accomplished with MBB. This can be followed by image-guided thermal ablation.
- Discography is not recommended (Aprill & Bogduk, 1992; Nordin et al., 2008).
- The use of additional imaging procedures should be determined in a case-by-case manner, and the evaluation of patients with chronic neck pain should follow this "tailor-made" approach.

#### Anticipated Exceptions

Nephrogenic systemic fibrosis (NSF) is a disorder with a scleroderma-like presentation and a spectrum of manifestations that can range from limited clinical sequelae to fatality. It appears to be related to both underlying severe renal dysfunction and the administration of gadolinium-based contrast agents. It has occurred primarily in patients on dialysis, rarely in patients with very limited glomerular filtration rate (GFR) (i.e.,  $<30$  mL/min/1.73 m<sup>2</sup>), and almost never in other patients. There is growing literature regarding NSF. Although some controversy and lack of clarity remain, there is a consensus that it is advisable to avoid all gadolinium-based contrast agents in dialysis-dependent patients unless the possible benefits clearly outweigh the risk, and to limit the type and amount in patients with estimated GFR rates  $<30$  mL/min/1.73 m<sup>2</sup>. For more information, please see the American College of Radiology (ACR) Manual on Contrast Media (see the "Availability of Companion Documents" field).

#### Abbreviations

- ACDF, anterior cervical discectomy and fusion
- AP, anteroposterior
- CT, computed tomography
- MBB, medial branch nerve blocks
- MRI, magnetic resonance imaging
- OPLL, ossification of the posterior longitudinal ligament
- SPECT, single photon emission CT
- Tc, technetium

#### Relative Radiation Level Designations

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
O	0 mSv	0 mSv
<input type="text"/>	<0.1 mSv	<0.03 mSv
<input type="text"/> <input type="text"/>	0.1-1 mSv	0.03-0.3 mSv
<input type="text"/> <input type="text"/> <input type="text"/>	1-10 mSv	0.3-3 mSv
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	10-30 mSv	3-10 mSv
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	30-100 mSv	10-30 mSv
*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (e.g., region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "Varies".		

Clinical Algorithm(s)

Algorithms were not developed from criteria guidelines.

Scope

Disease/Condition(s)

Chronic neck pain

Guideline Category

Diagnosis

Evaluation

Clinical Specialty

Family Practice

Internal Medicine

Neurological Surgery

Neurology

Nuclear Medicine

Orthopedic Surgery

Pediatrics

Radiology

Rheumatology

Intended Users

Health Plans

Hospitals

Managed Care Organizations

Physicians

Utilization Management

## Guideline Objective(s)

To evaluate the appropriateness of initial radiologic examinations for patients with chronic neck pain

## Target Population

Patients with chronic neck pain regardless of the etiology (trauma, arthritis, neoplasm)

## Interventions and Practices Considered

1. X-ray
  - Cervical spine
  - Myelography, cervical spine
  - Cervical spine flexion extension lateral views
2. Magnetic resonance imaging (MRI) cervical spine
  - Without contrast
  - Without and with contrast
3. Facet injection/medial branch block cervical spine
4. Computed tomography (CT) cervical spine
  - Without contrast
  - With contrast
  - Without and with contrast
5. Technetium (Tc)-99m bone scan with single photon emission computed tomography (SPECT) neck
6. Myelography and post myelography CT cervical spine

Note: X-ray discography was considered but not recommended.

## Major Outcomes Considered

Utility of radiologic examinations in differential diagnosis

## Methodology

### Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

### Description of Methods Used to Collect/Select the Evidence

Literature Search Procedure

Staff will search in PubMed only for peer reviewed medical literature for routine searches. Any article or guideline may be used by the author in the

narrative but those materials may have been identified outside of the routine literature search process.

The Medline literature search is based on keywords provided by the topic author. The two general classes of keywords are those related to the condition (e.g., ankle pain, fever) and those that describe the diagnostic or therapeutic intervention of interest (e.g., mammography, MRI).

The search terms and parameters are manipulated to produce the most relevant, current evidence to address the American College of Radiology Appropriateness Criteria (ACR AC) topic being reviewed or developed. Combining the clinical conditions and diagnostic modalities or therapeutic procedures narrows the search to be relevant to the topic. Exploding the term "diagnostic imaging" captures relevant results for diagnostic topics.

The following criteria/limits are used in the searches.

1. Articles that have abstracts available and are concerned with humans.
2. Restrict the search to the year prior to the last topic update or in some cases the author of the topic may specify which year range to use in the search. For new topics, the year range is restricted to the last 10 years unless the topic author provides other instructions.
3. May restrict the search to Adults only or Pediatrics only.
4. Articles consisting of only summaries or case reports are often excluded from final results.

The search strategy may be revised to improve the output as needed.

## Number of Source Documents

The total number of source documents identified as the result of the literature search is not known.

## Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

### Rating Scheme for the Strength of the Evidence

Strength of Evidence Key

Category 1 - The conclusions of the study are valid and strongly supported by study design, analysis and results.

Category 2 - The conclusions of the study are likely valid, but study design does not permit certainty.

Category 3 - The conclusions of the study may be valid but the evidence supporting the conclusions is inconclusive or equivocal.

Category 4 - The conclusions of the study may not be valid because the evidence may not be reliable given the study design or analysis.

## Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

### Description of the Methods Used to Analyze the Evidence

The topic author drafts or revises the narrative text summarizing the evidence found in the literature. American College of Radiology (ACR) staff draft an evidence table based on the analysis of the selected literature. These tables rate the strength of the evidence (study quality) for each article included in the narrative text.

The expert panel reviews the narrative text, evidence table, and the supporting literature for each of the topic-variant combinations and assigns an appropriateness rating for each procedure listed in the table. Each individual panel member assigns a rating based on his/her interpretation of the available evidence.

More information about the evidence table development process can be found in the ACR Appropriateness Criteria® Evidence Table Development document (see the "Availability of Companion Documents" field).



## Methods Used to Formulate the Recommendations

Expert Consensus (Delphi)

## Description of Methods Used to Formulate the Recommendations

### Rating Appropriateness

The appropriateness ratings for each of the procedures included in the Appropriateness Criteria topics are determined using a modified Delphi methodology. A series of surveys are conducted to elicit each panelist's expert interpretation of the evidence, based on the available data, regarding the appropriateness of an imaging or therapeutic procedure for a specific clinical scenario. American College of Radiology (ACR) staff distribute surveys to the panelists along with the evidence table and narrative. Each panelist interprets the available evidence and rates each procedure. The surveys are completed by panelists without consulting other panelists. The appropriateness rating scale is an ordinal scale that uses integers from 1 to 9 grouped into three categories: 1, 2, or 3 are in the category "usually not appropriate"; 4, 5, or 6 are in the category "may be appropriate"; and 7, 8, or 9 are in the category "usually appropriate." Each panel member assigns one rating for each procedure for a clinical scenario. The ratings assigned by each panel member are presented in a table displaying the frequency distribution of the ratings without identifying which members provided any particular rating.

If consensus is reached, the median rating is assigned as the panel's final recommendation/rating. Consensus is defined as eighty percent (80%) agreement within a rating category. A maximum of three rounds may be conducted to reach consensus. Consensus among the panel members must be achieved to determine the final rating for each procedure.

If consensus is not reached, the panel is convened by conference call. The strengths and weaknesses of each imaging procedure that has not reached consensus are discussed and a final rating is proposed. If the panelists on the call agree, the rating is proposed as the panel's consensus. The document is circulated to all the panelists to make the final determination. If consensus cannot be reached on the call or when the document is circulated, "No consensus" appears in the rating column and the reasons for this decision are added to the comment sections.

This modified Delphi method enables each panelist to express individual interpretations of the evidence and his or her expert opinion without excessive influence from fellow panelists in a simple, standardized and economical process. A more detailed explanation of the complete process can be found in additional methodology documents found on the [ACR Web site](#)  (see also the "Availability of Companion Documents" field).

## Rating Scheme for the Strength of the Recommendations

Not applicable

## Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

## Method of Guideline Validation

Internal Peer Review

## Description of Method of Guideline Validation

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

## Evidence Supporting the Recommendations

## References Supporting the Recommendations

Aprill C, Bogduk N. The prevalence of cervical zygapophyseal joint pain. A first approximation. *Spine (Phila Pa 1976)*. 1992 Jul;17(7):744-7. [PubMed](#)

Boutin RD, Steinbach LS, Finnesey K. MR imaging of degenerative diseases in the cervical spine. *Magn Reson Imaging Clin N Am*. 2000 Aug;8(3):471-90. [118 references] [PubMed](#)

Chen CJ, Hsu HL, Niu CC, Chen TY, Chen MC, Tseng YC, Wong YC, Wang LJ. Cervical degenerative disease at flexion-extension MR imaging: prediction criteria. *Radiology*. 2003 Apr;227(1):136-42. [PubMed](#)

Kaale BR, Krakenes J, Albrektsen G, Wester K. Whiplash-associated disorders impairment rating: neck disability index score according to severity of MRI findings of ligaments and membranes in the upper cervical spine. *J Neurotrauma*. 2005 Apr;22(4):466-75. [PubMed](#)

Nordin M, Carragee EJ, Hogg-Johnson S, Weiner SS, Hurwitz EL, Peloso PM, Guzman J, van der Velde G, Carroll LJ, Holm LW, Cote P, Cassidy JD, Haldeman S, Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated. Assessment of neck pain and its associated disorders: results of the Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders. *Spine (Phila Pa 1976)*. 2008 Feb 15;33(4 Suppl):S101-22. [125 references] [PubMed](#)

Spitzer WO, Skovron ML, Salmi LR, Cassidy JD, Duranceau J, Suissa S, Zeiss E. Scientific monograph of the Quebec Task Force on Whiplash-Associated Disorders: redefining "whiplash" and its management. *Spine (Phila Pa 1976)*. 1995 Apr 15;20(8 Suppl):1S-73S. [436 references] [PubMed](#)

## Type of Evidence Supporting the Recommendations

The recommendations are based on analysis of the current literature and expert panel consensus.

## Benefits/Harms of Implementing the Guideline Recommendations

### Potential Benefits

Selection of appropriate radiologic imaging procedures for diagnosis and evaluation of patients with chronic neck pain

### Potential Harms

#### Gadolinium-based Contrast Media

Nephrogenic systemic fibrosis (NSF) is a disorder with a scleroderma-like presentation and a spectrum of manifestations that can range from limited clinical sequelae to fatality. It appears to be related to both underlying severe renal dysfunction and the administration of gadolinium-based contrast agents. It has occurred primarily in patients on dialysis, rarely in patients with very limited glomerular filtration rate (GFR) (i.e., <30 mL/min/1.73 m<sup>2</sup>), and almost never in other patients. Although some controversy and lack of clarity remain, there is a consensus that it is advisable to avoid all gadolinium-based contrast agents in dialysis-dependent patients unless the possible benefits clearly outweigh the risk, and to limit the type and amount in patients with estimated GFR rates <30 mL/min/1.73 m<sup>2</sup>. For more information, please see the American College of Radiology (ACR) Manual on Contrast Media (see "Availability of Companion Documents" field).

#### Relative Radiation Level (RRL) Information

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to

estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, both because of organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared to those specified for adults (see Table in the "Major Recommendations" field). Additional information regarding radiation dose assessment for imaging examinations can be found in the American College of Radiology (ACR) Appropriateness Criteria® Radiation Dose Assessment Introduction document (see the "Availability of Companion Documents" field).

## Contraindications

### Contraindications

Contraindications to magnetic resonance imaging (MRI) examination include presence of a cardiac pacemaker or severe claustrophobia.

## Qualifying Statements

### Qualifying Statements

The American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists, and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

## Implementation of the Guideline

### Description of Implementation Strategy

An implementation strategy was not provided.

## Institute of Medicine (IOM) National Healthcare Quality Report Categories

### IOM Care Need

Living with Illness

### IOM Domain

Effectiveness

# Identifying Information and Availability

## Bibliographic Source(s)

Newman JS, Weissman BN, Angevine PD, Appel M, Arnold E, Bencardino JT, Fries IB, Hayes CW, Hochman MG, Holly LT, Jacobson JA, Math KR, Murphey MD, O'Toole JE, Rubin DA, Scharf SC, Small KM, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® chronic neck pain. [online publication]. Reston (VA): American College of Radiology (ACR); 2013. 14 p. [61 references]

## Adaptation

Not applicable: The guideline was not adapted from another source.

## Date Released

1998 (revised 2013)

## Guideline Developer(s)

American College of Radiology - Medical Specialty Society

## Source(s) of Funding

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

## Guideline Committee

Committee on Appropriateness Criteria, Expert Panel on Musculoskeletal Imaging

## Composition of Group That Authored the Guideline

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## Financial Disclosures/Conflicts of Interest

Not stated

## Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Daffner RH, Weissman BN, Angevine PD, Arnold E, Bancroft L, Bennett DL, Blebea JS, Bruno MA, Fries IB, Holly L, Jacobson JA, Luchs JS, Morrison WB, Resnik CS, Roberts CC, Schweitzer ME, Seeger LL, Stoller DW, Taljanovic MS, Wise JN, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® chronic neck pain. [online publication]. Reston (VA): American College of Radiology (ACR); 2010. 9 p.

## Guideline Availability

Electronic copies: Available from the [American College of Radiology \(ACR\) Web site](#) .

Print copies: Available from the American College of Radiology, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

## Availability of Companion Documents

The following are available:

- ACR Appropriateness Criteria®. Overview. Reston (VA): American College of Radiology; 2 p. Electronic copies: Available in Portable Document Format (PDF) from the [American College of Radiology \(ACR\) Web site](#) .
- ACR Appropriateness Criteria®. Literature search process. Reston (VA): American College of Radiology; 1 p. Electronic copies: Available in PDF from the [ACR Web site](#) .
- ACR Appropriateness Criteria®. Evidence table development – diagnostic studies. Reston (VA): American College of Radiology; 2013 Nov. 3 p. Electronic copies: Available in PDF from the [ACR Web site](#) .
- ACR Appropriateness Criteria®. Radiation dose assessment introduction. Reston (VA): American College of Radiology; 2 p. Electronic copies: Available in PDF from the [ACR Web site](#) .
- ACR Appropriateness Criteria®. Manual on contrast media. Reston (VA): American College of Radiology; 90 p. Electronic copies: Available in PDF from the [ACR Web site](#) .
- ACR Appropriateness Criteria®. Procedure information. Reston (VA): American College of Radiology; 1 p. Electronic copies: Available in PDF from the [ACR Web site](#) .
- ACR Appropriateness Criteria® chronic neck pain. Evidence table. Reston (VA): American College of Radiology; 2013. 24 p. Electronic copies: Available in PDF from the [ACR Web site](#) .

## Patient Resources

None available

## NGC Status

This summary was completed by ECRI on May 6, 2001. The information was verified by the guideline developer as of June 29, 2001. This NGC summary was updated by ECRI on January 27, 2006. This NGC summary was updated by ECRI Institute on June 30, 2009. This NGC summary was updated by ECRI Institute on December 6, 2010. This NGC summary was updated by ECRI Institute on February 27, 2014.

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